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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/531,245

04/14/2005

John Joseph Senkevich

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EXAMINER

MALEKZADEH, SEYED MASOUD

ART UNIT

PAPER NUMBER

1722

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

02/23/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/531,245

Applicant(s)

SENKEVICH ET AL.

ExaminerSEYED MASOUD
MALEKZADEH**Art Unit**

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11-17 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04/14/2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>04/14/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 13 recite the limitation "the precursor is a metal β -diketonate compound" in lines 1 and 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 14 recite the limitation "the precursor is a metal-hfac compound" in lines 1 and 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 15 recite the limitation "the precursor is selected from Pd(hfac)₂, Ru(hfac)₂, Pt(hfac)₂, Ir(hfac)₂, Ir(acac)₂, Pd(tmhd)₂, Ru(tmhd)₂, Rh(tmhd)₂, Pt(tmhd)₂, and Ir(tmhd)₂" in lines 1-3. There is insufficient antecedent basis for this limitation in the claim.

Claim 17 recite the limitation "the precursor is Pd(hfac)₂" in lines 1 and 2. There is insufficient antecedent basis for this limitation in the claim.

Claims 13-15 and 17, which teach the step of using different precursor in the ALD process, are dependent to claim 1, but claim 1 does not teach the step of using a precursor in ALD process. Therefore, There are insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

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The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6 and 13-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Dela Rosa et al (US 6,527,855).

DelaRosa et al ('855) discloses an atomic layer deposition (ALD) process comprised of depositing a layer from a metallorganic precursor on a noble or semi-noble metal substrate, using a hydrogen reducing agent. The metal of the deposited layer may be Pd, Rh, Ru, Pt, Ir, Ag, Au, Ni, Co, Fe and the substrate is a metal nitride or a metal oxide substrate (See lines 1-8, column 2). DelaRosa et al ('855) further discloses that the temperatures typically used range from about 200° C to about 400° C (See lines 51-52, column 3).

DelaRosa et al ('855) also teaches that the ALD process is performed by sequentially pulsing a precursor vapor or gas, and a reducing agent gas (See lines 8-12, column 3).

DelaRosa et al ('855) further discloses a substrate for the deposition may be any suitable substrate but in particular, may be tantalum, silicon, silicon dioxide or fluorinated silica glass. (See lines 19-25, column 4).

Moreover, DelaRosa et al ('855) discloses the metallorganic precursor is composed of the metal and one or more ligands, where the ligand may be any bidentate ligand. The examples of precursors include acetylacetonate (acac) compounds, β -

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diketonate compounds such as metal β -diketonate compounds, 4-pentafluoro (hfa or hfac) compounds which includes metal-hfac compounds such as Pd(hfac)₂, Ru(hfac)₂, Rh(hfac)₂, Pt(hfac)₂, Ir (hfac)₂. (See lines 44-67, column 2).

DelaRosa et al ('855) further teaches that substrate surface was pretreated before deposition process by heating the substrate surface plate. (See lines 30-32, column 4).

The prior art, thus, meets all the claim limitations, and therefore, DelaRosa et al ('855) anticipates the claims 1-6 and 13-17.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 7-8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over DelaRosa et al ('855) in view of Hujanen et al. (WO 02/45167).

DelaRosa et al ('855) discloses all the limitations of Atomic Layer Deposition (ALD) method as discussed above. However, DelaRosa et al ('855) does not teach pulsing into the chamber a reducing gas selected from glyoxylic acid, oxalic acid, formaldehyde, 2-propanol, and imidazole as to limitations of claims 7 and 8. DelaRosa et al ('855) also does not disclose pulsing a plasma-activated hydrogen gas into the chamber as claimed in claim 12.

In the analogous art, Hujanen et al. (WO 02/45167) teaches a method of forming magnetic structures by depositing thin film through atomic layer deposition (ALD) process by using metal source and reducing gases such as hydrogen, plasma activated hydrogen, alcohols, and carboxylic acids (glyoxylic acid belongs to groups of carboxylic acids). (See page 3, lines 1-7 and page 5, lines 23-27).

It would have been obvious to one of ordinary skill in this art at the time of applicant's invention to modify atomic layer deposition process of DelaRosa et al ('855) by providing the step of pulsing into the process chamber a glyoxylic acid gas as a reducing agent as indicated in the limitations of claims 7-8 and pulsing plasma-activated hydrogen gas in to the process chamber as indicated in the limitations of claim 12 in order to improve the reducing process of metal ions to elemental state, and to eliminate oxide impurities during ALD process, as suggested by Hujanen et al ('167).

Claims 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over DelaRosa et al ('855) and Hujanen et al ('167) as applied to claims 7-8 of above, and further in view of Pan et al (US 2003/0054149).

DelaRosa et al ('855) and Hujanen et al ('167) disclose all the limitations of Atomic Layer Deposition (ALD) method as discussed above. However, DelaRosa et al ('855) and Hujanen et al ('167) do not teach about the use of an activated dielectric surface as a substrate wherein the activated dielectric comprises at least one of thiol, sulfide, tetra sulfide, phosphine, phosphide or amine groups as claimed in claim 9. Furthermore, DelaRosa et al ('855) and Hujanen et al ('167) do not teach that the dielectric surface is selected from CVD polymers, organic-inorganic hybrids, and silicon or metals having an oxide terminated surface as claimed in claim 11.

In the analogous art, Pan ('149) discloses a process for the fabrication of a porous coating on top of an open-structure substrate (See Paragraph [001]). Pan ('149) further discloses the open structure substrate coated by a metals oxide or sulfide (See paragraph [0016] and [0017]). Pan ('149) further teaches depositing a layer of catalytic coating on the porous coating surface which is a metal oxide or metal sulfide as a substrate surface by ALD process (See paragraph [0025]).

It would have been obvious to one of ordinary skill in this art at the time of applicant's invention to modify DelaRosa et al ('855) and Hujanen et al ('167) by including the step of using a dielectric substrate surface such as sulfide as claimed in claim 9 and using substrates having an oxide terminated surface as a dielectric substrate surface as claimed in claim 11 in order to minimize the electrical conductivity of the substrate surface used in ALD process because dielectric substrates have a high dielectric constants, as suggested by Pan et al ('149).

Allowable Subject Matter

Claim 10 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record fails to teach or suggest the use of thiol groups as an activated dielectric substrate surface in ALD process. The closest prior art of DelaRosa et al (US 6,527,855), Hujanen et al (WO 02/45167), Pan (US 2003/0054149), Gates (US 6,203,613) are described above. These references do not teach or suggest the use of thiol groups as an activated dielectric substrate surface in Atomic Layer Deposition process.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Masoud Malekzadeh whose telephone number is 571-272-6215. The examiner can normally be reached on Monday – Friday at 8:30 am – 5:00 pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra N. Gupta can be reached on (571) 272-1316. The fax number for the organization where this application or proceeding is assigned is 571-272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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